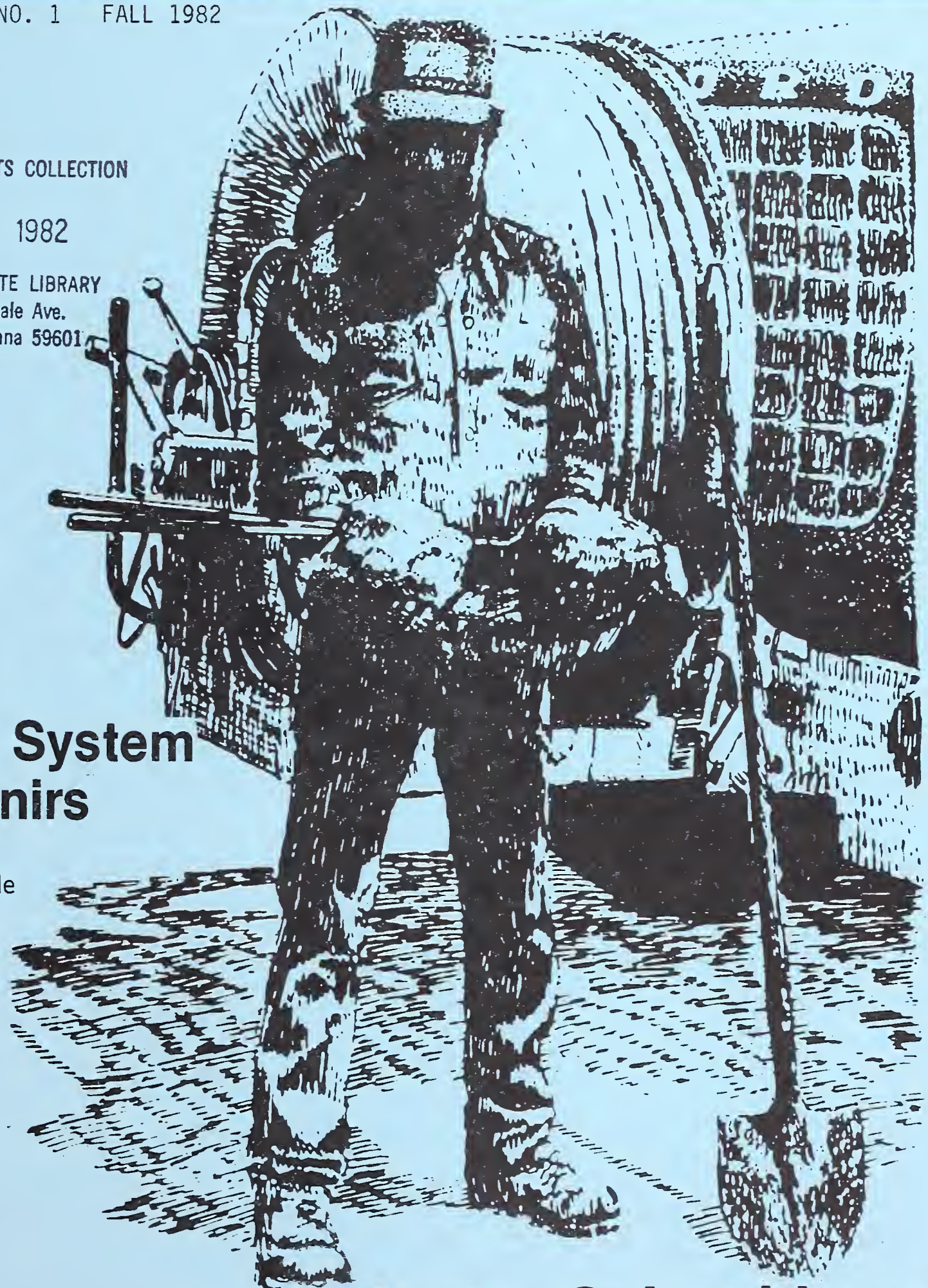
Big Sky Clearwater

VOL. XII NO. 1 FALL 1982



Sewer System Souvenirs

Story Inside

Water School Issue

Helena Cave-In Tragedy

On July 20, 1982 at about 1:15 p.m. one man was killed and two others injured when a 15 foot deep trench caved in on the construction workers. The accident occurred when the workers were laying pipeline for a storm drain relocation project which is part of the rennovation of Helena's Capital Hill Mall. The man who died was buried under about one foot of dirt. Other men in the ditch attempted to dig the buried man out but it was too late. He apparently suffocated from the pressure of the dirt covering him.

This terrible accident reminds us all of the dangers involved when working in open trenches. Trenching safety, though often ignored, has once again been shown to be a life and death issue. How many times have you worked in an unsafe trench or seen someone else endangering their life in this way? Please try to follow these trenching safety guidelines which were taken from AWWA's Safety Practice for Water Utilities.

Trenching Safety Stressed

These are just a few of the important safety items. For further informaton contact:

Montana State Department of
Labor and Industry
Safety and Health Bureau
815 Front Street
Helena, MT 59604
(406)449-3972

1. When the depth of a trench exceeds 5 feet, bracing or shoring should be used, or the bank should be cut back to a safe angle of repose. This is especially critical in sandy, loose or water saturated soils.

2. When working in a trench four feet deep or more, an adequate means of escape, such as a ladder or steps must be provided and located so as to require no more than 25 feet of lateral travel.

3. Wear an approved hard hat.

The Big Sky Clearwater--for water and wastewater-treatment operators across Montana--is published two times a year by the Water Quality Bureau of the State Department of Health and Environmental Sciences in cooperation with the Montana Section American Water Works Association and the Montana Water Pollution Control Association.

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4. Be careful to remove earth and other material in such a way that overhanging banks are avoided. If under-cutting is necessary, provide adequate bracing.

5. Do not place excavated material closer than two feet from the edge of a trench. Keep all tools, working materials and loose objects orderly and away from the edge of the trench.

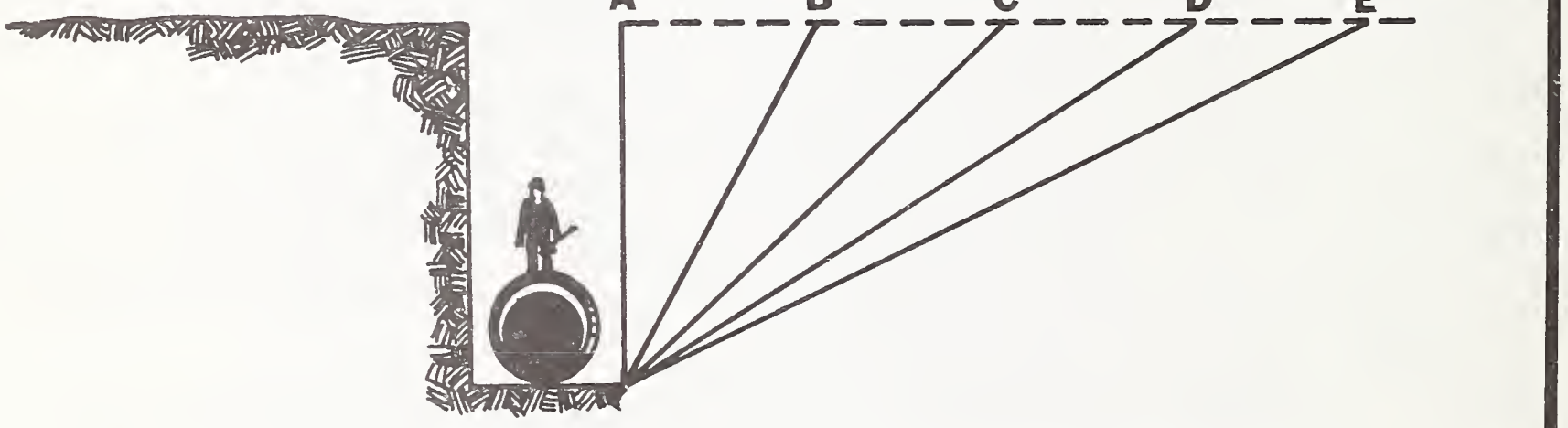
6. The sides and rim of all open trenches should be inspected frequently to avoid cave-in. Earth moving equipment should be operated from a position which will not imperil personnel or property by cave-in due to vibration, stress or dead weight.

7. Provide and maintain all necessary barriers, temporary bridges and walks, warning signs, flags, flares, lights and, when necessary, watchmen and flag men for the protection of workers, vehicles and pedestrians.

8. Be careful!

Approximate Angle of Repose

For Sloping Sides of Excavations



A. 90° - Solid rock, shale or cemented sand and gravels

B. 63° or 1/2 to 1 - Compacted angular gravels

C. 45° or 1 to 1 - Recommended slope for average soils

D. 33° or 1 1/2 to 1 - Compacted sharp sand

E. 26° or 2 to 1 - Well-rounded loose sand

On the Cover

Foreman Moses Gonzales has been extracting some unusual things from Hardin's sewer system these days, with a little help from the new Vactor Jet Rodder in the city purchased with the help of a Montana Coal Board Grant. Besides sucking an assortment of boulders from the lines, Gonzales found a shovel and a couple of golf clubs. He joked that if he keeps at the sewer cleaning business long enough, he might soon have a full set of clubs.

Forty-Ninth Annual School

The 49th Annual School and Conference for Water and Wastewater Operators and Managers will be held September 13-16 at the MSU Student Union Building, SUB, in Bozeman. Operator certification exams will be given on Friday, September 17, from 8:30 a.m. - 12:30 p.m. in Room 220 of the SUB.

The fee for attending the school and conference is $45.00 and is payable during registration at the school.

The program this year includes two extensive workshops on chlorination and pump maintenance. There will be process control topics for plant operators and topics for distribution and collection personnel also. The Sessions for Operator Study (SOS) will provide assistance in math and other pertinent topics for operators preparing to take the certification exam on Friday. NOTE: To be fully prepared to pass your certification exam, you must obtain the appropriate study materials and study them prior to attending the school. Use the SOS for boning up on your math, for asking questions, and for general review. The school program is geared for the continuing education of both new and experienced operators and is not intended solely for certification preparation. Remember, your individual study is a must!

Tentative School Schedule

Monday, September 13

morning

7:30 Registration
8:30 Welcome
8:45 School Objectives
9:00 Certification Review
9:30 Break
10:00 Public Relations
11:45 Lunch

afternoon

Session 1 - Water

1:00 An Overview of Water Treatment
2:30 Break
3:00 Overview (cont.)
4:00 Session for Operator Study (SOS)

Session 2 - Wastewater

1:00 An Overview of Wastewater
2:30 Break
3:00 Overview (cont.)
4:00 SOS

Herman Schmidt is just about fed up. He's going to do five or six more holes, and if he doesn't spear a fish with this dumb thing, he's going to return it to the hardware store.

Tuesday, September 14

morning

Session 1 - Water

8:00	Chlorination Workshop
10:00	Break
10:45	Chlorination (cont.)
12:00	Lunch

Session 2 - Wastewater

8:00	Seals and Packing Technology and Pump Maintenance
10:00	Break
10:15	Seals & Packing (cont.)
12:00	Lunch

afternoon

Session 1 - Water

1:00	Seals and Packing Technology and Pump Maintenance
2:30	Break
2:45	Seals and Packing (cont.)
5:15	SOS

Session 2 - Wastewater

1:00	Chlorination Workshop
2:30	Break
2:45	Chlorination (cont.)
5:15	SOS

Wednesday, September 15

morning

Session 1 - Water

8:00	Direct Filtration; Operational Experiences at Conrad, Stevensville and Colstrip
10:00	Break
10:15	Water Distribution System Maintenance
11:45	Lunch

Session 2 - Wastewater

8:00	Treatment Plant Case Studies at Livingston, Colstrip and Bozeman
10:00	Break
10:15	Microbiology of Wastewater (General aspects and fecal coliforms)
11:45	Lunch

afternoon

Session 1 - Water

1:00 Maintenance and Repair of Wells
2:30 Break
2:45 Microbiology of Water (Giardia lamblia and total coliforms)
4:15 SOS

Session 2 - Wastewater

1:00 Wastewater Collection System Maintenance
2:30 Break
2:45 Lagoons and Package Plants
4:15 SOS

Thursday, September 16

morning

Session 1 - Water

8:00 Purpose and Use of Polymers in Water Treatment; Jar Testing
10:00 Break

Session 2 - Wastewater

8:00 Sludge Digestion - Aerobic and Anaerobic
10:00 Break

Joint Session

10:30 Proper Trenching and Excavation Techniques
11:45 Lunch

afternoon

Joint Session

1:00 Conservation of Water and Energy
3:00 Awarding of Certificates
3:30 School Ends

FOR HAZARDOUS MATERIAL EMERGENCIES
CALL DISASTER & EMERGENCY SERVICES—DAY OR NIGHT
(AREA CODE 406) 449-3034

MONTANA POISON CONTROL SYSTEM
1-800-525-5042

Water Test Results - Bacteria

by Rick Rosa, Sanitary Engineer
Water Quality Bureau

CONFLUENT GROWTH. Too numerous too count. Three tubes positive. Three coliforms present. Sample voided due to age.

All of the above are possible results for drinking water samples that have been sent to be tested for the presence of bacteria, but exactly what does each one mean? How is the supplier to deal with each? What happens if a supplier shirks his or her responsibilites, either inadvertently or purposely? The following is an attempt to answer some of the most common questions.

First of all, it is impossible for laboratories to test for the large number of disease-producing (pathogenic) organisms that may be found in a contaminated water supply system. What they do test for is coliform bacteria. Coliform bacteria occur normally in the intestines of man and animals and are discharged in large numbers in human and animal wastes. They are not disease producers themselves but are often associated with pathogenic organisms. Since coliform bacteria are present in far greater numbers than disease-causing organisms and are usually more hardy:

1. Their absence from water is an indication that the water is bacteriologically safe for human consumption.

2. Their presence is an indication that pathogenic organisms may also be present and that the water is unsafe to drink.

Testing Procedure and Results

Bacteria are similar to plants. Their presence in a sample of water may be found in very much the same manner as determining the presence of a seed in a sample of soil. If proper fertility, moisture, temperature and time for growth are provided, the seed will germinate and its presence be discovered. If a sample of water is placed in a tube or on a membrane filter which contains food (lactose broth) and moisture, then incubated at the

Certification Exam Date

The examinations will be given at the conclusion of the annual Water School to be held on the MSU campus September 13-16. Attendance at the school is not required in order to take the exam. However, those who plan to take examinations should notify the certification office and submit applications and fees before September 3, 1982. The exam will be given on Friday, September 17, 1982, from 8:30 a.m. to 12:30 p.m. in Room 220, Strand Student Union Building, MSU Campus, Bozeman, Montana.

Those who hold temporary certificates for Class 1, 2 and 3 operators <u>are required</u> to take their examinations on September 17 unless a valid excuse is submitted to the Montana Board of Certification.

For further information, or to obtain an application, contact:

Rosemary Fossum
Office of Water/Wastewater Operator Certification
Room A206, Cogswell Building
Helena, MT 59620

proper temperature for the required time, the bacteria, if present, will grow causing the lactose to ferment. In the case of the tube, a gas bubble is created by the fermentation. The membrane filter will display separate bacterial colonies.

Since the water submitted for testing is placed into five tubes, when the multiple tube technique is used, a count is made of those tubes which display a gas bubble and this value is recorded on the analysis sheet. If one tube is positive, the result is recorded as 1+, 4-; if two tubes are positive, the result is 2+, 3-; etc. If gas bubbles are not found in any of the tubes, the result is 5-. When the membrane filter technique is used, the bacterial colonies present on the filter are counted and this number is recorded on the report form. Theoretically, each colony represents a single coliform organism, if two colonies are present, the value is recorded as 2 (coliform organisms)/100 milliliters; 8 colonies as 8/100 ml; etc. If the sample is satisfactory (coliform bacteria are not present), the result is expressed as < (less than) 1/100 ml.

Sometimes there may be bacteria present in the water other than the coliform group. If these organisms are present in large numbers, the entire surface of the membrane filter may be covered with growth or the number of colonies may be too numerous to accurately count. In the case of the tube method, large numbers of bacteria cause the lactose broth to become cloudy. The sample results are then reported as confluent growth or too numerous to count (TNTC). A water supplier should be concerned about obtaining such results because:

1. If there are a lot of other bacteria present, the coliform organism may not be detected, and
2. There are many other bacteria that can represent a potential health hazard, given favorable conditions. These bacteria are particularly harmful to those people whose resistance to disease is low, such as the newborn, the aged and the sick.

Check Samples and Public Notice

Sometimes a bad sample does not necessarily prove that the water supply is contaminated and need not be regarded as such proof until the point from which the sample was taken has been rechecked. The possibility of the first sample having been contaminated in taking or handling is always present. The sampling point should be checked for conditions that might prevent a representative sample from being obtained.

Any routine sample which indicates the presence of coliform organisms (positive tubes or colonies on a membrane filter) must be followed by check samples until <u>two</u> negative samples are obtained in a row. Such samples should be obtained <u>24 hours apart</u>. When a sample report is received which states "confluent growth" or "TNTC" (Too numerous to count - non coliform), <u>one</u> check sample is required. This is due to the fact that coliform organisms may not have been detected. The water supplier must submit the first check sample as soon as: (1) telephone notification of a bad sample is received from the Water Quality Bureau, or (2) the analysis report form is received which specifies that the sample was unsatisfactory, or (3) additional bottles are received from the laboratory (if the supplier doesn't have any spare bottles). In conjunction with check sampling, the water supply users must be notified that a possible contamination problem may exist.

If the second sample is also reported as having "coliform organisms present," measures should be taken to determine the source of contamination. Corrective action should be taken such as disinfection of the distribution system. The water users may be notified to boil their water until two consecutive check samples indicate that the contamination problem has been eliminated. If assistance is needed regarding detection and elimination of the water system problem, don't hesitate to contact your sanitarian or the Water Quality Bureau at 449-2406.

Too Old to Analyze

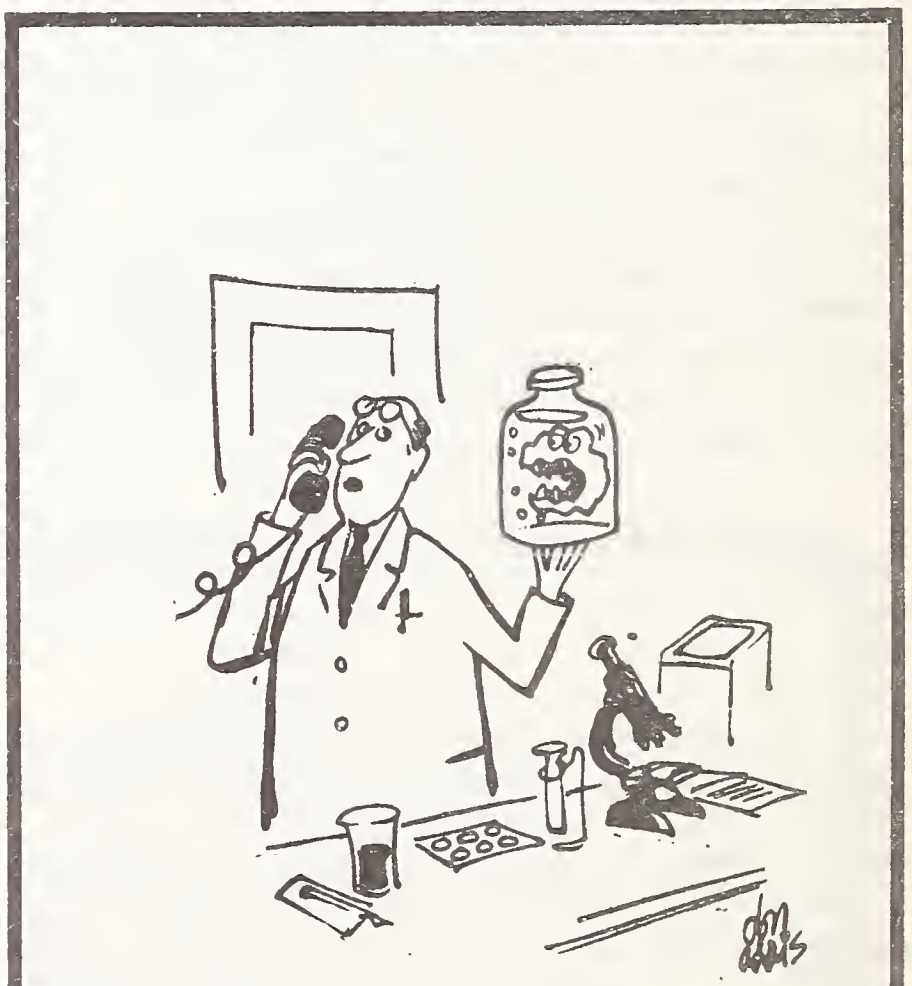
If the supplier receives notice that the sample was too old to analyze, this means that 48 hours have elapsed between the time the sample was collected and the time it was received in the laboratory. The quality of any sample which is 48 hours old is questionable and a new sample must be submitted. There are some steps which should be taken to avoid this irritating problem. First, check with your local post office to see when the mail leaves each day. If at all possible, collect your sample one or two hours before that time. Deliver the sample to the post office and mail it first class. Collect samples on Monday, Tuesday or Wednesday only.

In Summary

Please remember that you must give public notice whenever you fail to sample in any given month or if you exceed the maximum contaminant level, MCL, for coliform bacteria. It is the State's responsibility to notify your users if you don't, and chances are the State may not word things exactly the way you like. It is better to give your own notice and let the Water Quality Bureau know that notice was given.

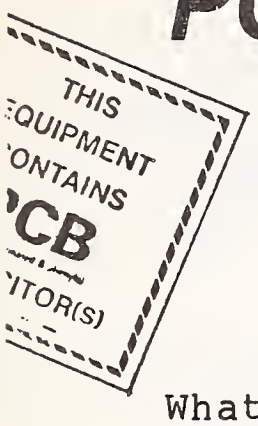
The microbiological quality of your water can change at any time and that is precisely why the State of Montana and the EPA require you to check it on a regular basis. Your water users expect a safe supply of water and frequent monitoring is the only means of assuring good quality. The water supplier must understand sampling procedure and sampling results in order to carry out his responsibilities to the customers as outlined in Montana law.

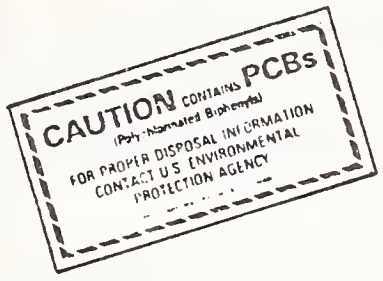
Excerpts taken from: "Coliforms - To Be or Not to Be," by Marge Richardson from the North Dakota Department of Health.

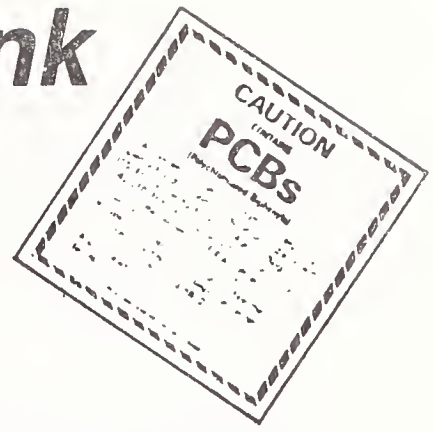


"The good news is, the bacteria count is down to one per gallon..."

PCB's Closer Than You Think







What do the slaughter of thousands of chickens, fluorescent light fixtures, carp in Lake Helena, and hunters taking pot shots at power transformers have in common?

These things all relate to a worldwide buildup of the mysterious chemicals called Polychlorinated biphenyls (PCB's).

The chicken/egg incident occurred when chicken feed at Pierce Packing in Billings became contaminated by PCB's. Did you know that many ballasts in fluorescent lights contain PCB's, just like the transformer that was recently bagged by some mischievous Helena area hunters. PCB's have become so widespread that they have even been detected in the fatty tissues of carp taken from Lake Helena.

PCB's is a term that is applied to certain mixtures of chlorinated organic compounds. They come in both solid and liquid forms and have properties that give them a wide range of industrial applications. They have been used in protective coatings, sealers in waterproofing compounds, asphaltic materials, printing inks, dielectrics, hydraulic fluids, lubricants and heat transfer media. The remarkable properties of PCB's have brought them into prominence and they are produced worldwide.

Unfortunately, PCB's are chemically stable and so tend to accumulate in the environment. They are found in samples of air, water, soils, sediments, fish, birds and mammals (including humans) all over the world. PCB's have been shown to cause birth defects and cancer in laboratory animals, and they are the suspected cause of other disorders. The World Health Organization lists PCB's as suspected carcinogens. In Japan in the late 60s when 2000 people mistakenly ate PCB contaminated cooking oil, they experienced skin lesions, facial swelling, neurological disorders, nausea, impotence and a few individuals died.

On December 22, 1975 the U.S. Environmental Protection Agency (EPA) announced a program to control PCB's in the environment. A timetable set up by EPA called for a gradual phase out of PCB manufacturing leading up to a ban on all PCB processing or distribution by July 1, 1979. These steps have reduced the amount of PCB's being introduced into the environment, however millions of pounds of PCB's still exist in transformers, ballasts, and capacitors still in service. The safe treatment and disposal of these fluids will continue to be a major concern for many years to come.

The following story about PCB's was submitted by Leonard Willett, Chief Operator at Helena's Missouri River Water Treatment Plant.

Do You Have PCB's In Your Plant?

During a routine check on April 20, 1982 at the Missouri River Treatment Plant, a fluorescent light was found to be out of order. Upon further inspection, it was found that the ballast was burned out and leaking an oily substance. Later in the day, when consulting with an electrical supplier, we found that this particular type of ballast was out of production because it contained PCB.

At the Missouri River Treatment Plant, which is a 6 M.G.D. peaking plant serving Helena's water needs in the summer we discovered that we had 54 light fixtures with ballasts containing PCB's, 32 of these were directly over water!

We in Helena, like most communities, are operating on budget restrictions. However, due to the potential hazard to both the plant employees and the community, we decided to do something about the PCB's. The total replacement cost of the PCB transformers would be $858.60. We contacted the EPA and they informed us about the proper disposal methods for PCB's. We accomplished the job of replacing the ballasts in short order. While talking with a representative of Universal Ballast Company, he informed me that they stopped making PCB ballasts 15 years ago. He also told me that 15 years ago hospitals across the United States became concerned about the potential health hazard and started converting to non-PCB ballasts. Many communities across the country have had unfortunate experiences with PCB's, both in industry and agriculture. Let's eliminate this potentially dangerous situation in treatment plants. Check your plant today! If you discover PCB's, talk to someone who knows the proper disposal methods. The EPA or your state or local health office are good places to start.

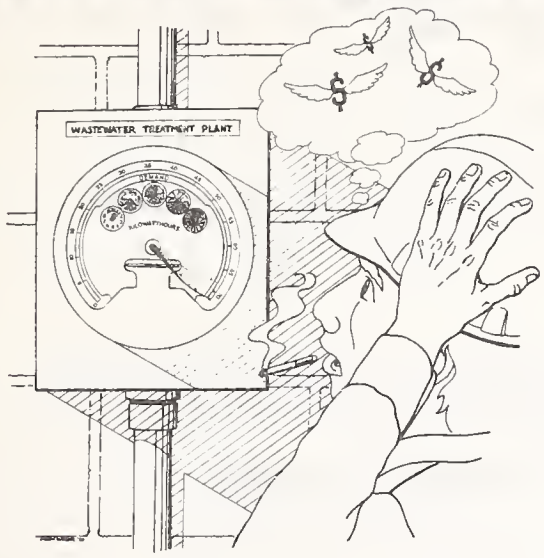
Energy Conservation Manuals Available

COPIES OF the full text of "Energy Conservation in the Design and Operation of Wastewater Treatment Facilities" are available from WPCF. The 144 page manual includes information on energy usage and costs for each stage of the treatment processes. It is fully illustrated and comes complete with references and index.

To order a copy, send $11.50 (members) or $15.00 (non-members) to Water Pollution Control Federation, Publication Order Department, 2626 Pennsylvania Ave., NW, Washington D.C. 00037. Order number MOP FD-2.

Copies of the "Operator Guide to Energy Conservation at Wastewater Treatment Plants" are also still available. This is the manual that was used at the seminar presented by M&I Engineers last October in Helena. This comprehensive and valuable manual is available for the cost of printing ($10.00). For your own copy, write to: M&I Inc. Consulting Engineers, 4710 S. College Ave., Fort Collins, CO 80525, phone (303)226-2323.

Conserving Energy



Measuring Power

By Jan Cranor and Rick Rosa
Water Quality Bureau

ARTICLES IN THE 1981 Big Sky Clearwater winter issue explained a few basic electrical concepts. Nameplate horsepower was used to estimate energy consumption and demand charge was calculated. This article will define the terms known as actual and apparent power while attempting to explain measurement of power usage.

The first step in determining power usage throughout the plant is to contact the area engineer for the utility company. The utility representative will help you to conduct a survey of the electrical equipment and determine incoming power voltage and amperage at the main instrument panel.

Power Equation

The rate of electrical energy conversion is termed power and the amount of power consumed can be determined from the following equation.

Power = Voltage x Current

$$P = V \times I$$

In a three-phase power system, the equation must be modified slightly to account for the power delivered by the additional phases.

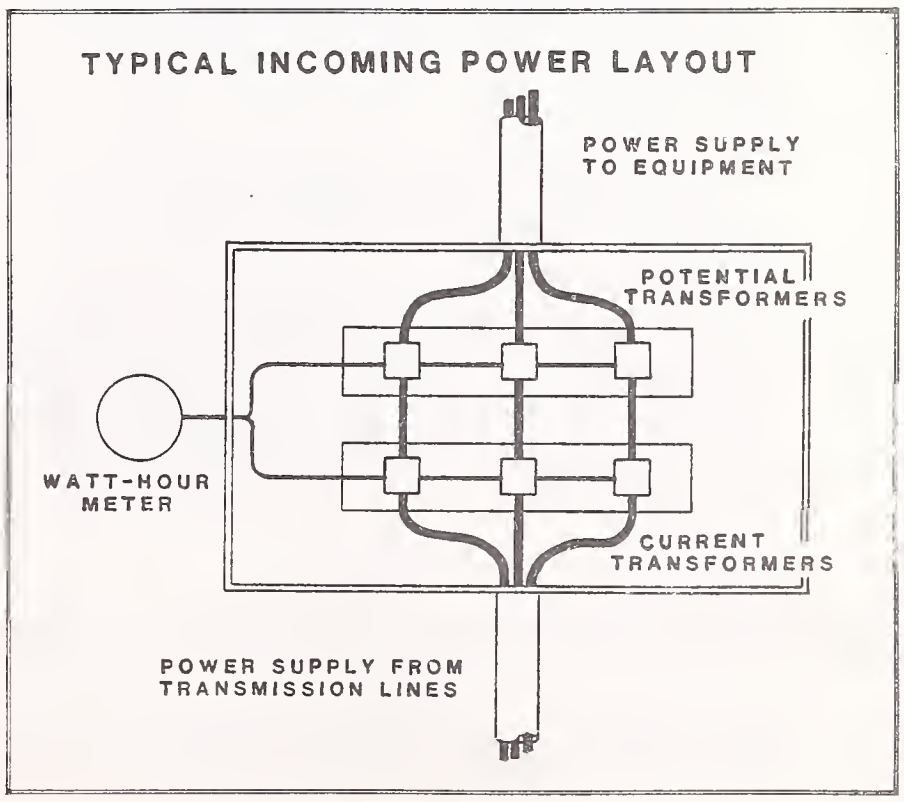
$$P = V \times I \times \sqrt{3}$$

Most motors use three-phase power. However, single phase power is provided for such items as heaters and equipment operated through electrical sockets.

Motors and transformers have a property known as inductance. These devices consume less actual or useful power than shown by the power equation. Some of the "apparent" power supplied to a motor is not used (called the reactive power --mostly given off as heat). The power which is used to do the work is termed actual power.

Apparent Power

The alternating current supplied by the power company consists of three separate currents which are out of phase from each other, thus the term three-phase power. Three separate lines enter the control panel, each representing a separate power phase. To determine the amperage of the incoming power,



measure the amps on each power phase and average the results. To find the voltage, measure the voltages between the three phases and average the values (refer to Figure I). The apparent power entering the plant can then be determined by the following equation.

KVA (Kilovolt-Amperes) =

$$\frac{\text{Volts} \times \text{Amps} \times \sqrt{3}}{1000}$$

Actual Power

Actual power used to do real work is measured by the watt-hour meter at the plant, since the meter does not measure reactive power. The actual power is typically expressed in kilowatts (kw). Determining the kw from a watt-hour meter requires some explanation.

1. Locate the value of the watt-hour constant (K_H), usually printed on the meter. This represents the number of watt-hours for one revolution of the meter.
2. Calculate the transformer ratio. If the meter voltage is the same as the line voltage, the TR equals one. If the voltages differ, obtain the value for the current and voltage ratios printed on the transformers located nearby. Multiply the two values to obtain TR.
3. Using a stop watch, measure the time in seconds for a fixed number of revolutions. For the purpose of computing the plant power factor, this measurement should be made at the same time that the amperage is being read on the main power line.

Now the actual power can be calculated from the following equation.

$$kw = K_H \times TR \times \frac{\text{Disc Revolution}}{\text{Number of Seconds}} \times 3.6$$

Example: $K_H = 1.8$

Current Transformer Ratio = 80/1, Potential TR Ratio = 2.5:

TR = 80 x 2.5 = 200

1 Revolution in 8 seconds

kw = 1.8 x 200 x 1/8 x 3.6 = 158

158 kw of actual power are being used in the plant.

Power Factor

Power factor is the name given to the ratio of actual power being used in a circuit to the power which is apparently being drawn from the line. For load devices containing only resistance, such as heaters, the actual and apparent power are the same and the power factor equals one. For motors and transformers with inductance, the actual power is less than the apparent power supplied and the power factor is some value less than one. The power factor is represented by the following equation.

$$\text{Power Factor} = \frac{\text{Actual Power}}{\text{Apparent Power}}$$

The previous values of actual and apparent power have already been calculated for the treatment plant so the plant power factor can now be calculated. This value can be used to determine the kw used by each piece of equipment.

For Example

A motor is supplied 480 volts and the average voltage is 52 amps. The plant power factor is 0.79.

Calculate KVA: $\frac{480 \times 52 \times \sqrt{3}}{1000} = 43$

kw = KVA x Power Factor

= 43 x 0.79 = 34

If the motor operated for 4 hours, the power consumed would be 34 x 4 = 136 KWH ■

Present Worth Analysis

Key to Polson's Success

By Terrance W. Richmond
Kalispell Branch Manager
Morrison-Maierle, Inc.

Nestled at the south end of Flathead Lake with a spectacular view of the snowcapped Mission Mountains, the city of Polson is a mecca for summer visitors. Add a large number of homeowners who only spend the summer in Polson and you have a population that fluctuates widely depending on the season.

In the preparation of Polson's wastewater facility plan, engineers determined that a properly designed aerated lagoon would meet the projected needs of the city. Needs were based on a population which is projected to fluctuate seasonally by 25 percent from 3,800 to 4,800 people by the year 2000. Fluctuations in loadings are also exerted by seasonal commercial contributors such as restaurants and motels.

In meeting their waste treatment demands it was equally important for Polson to achieve their water quality goal in the most cost effective manner. Recognizing that the total cost of any facility is not only dependent upon initial capital expenditures, but also annual operation and maintenance costs, the city of Polson authorized their consulting engineer, Morrison-Maierle, Inc., to investigate various methods that would result in the lowest total annual cost through the life of the facility, yet not compromise the water quality goal.

In order to construct a wastewater treatment facility based on present worth, two major factors must be considered: 1) the total capital cost or "first cost" and 2) the annual cost over the economic life of the plant.

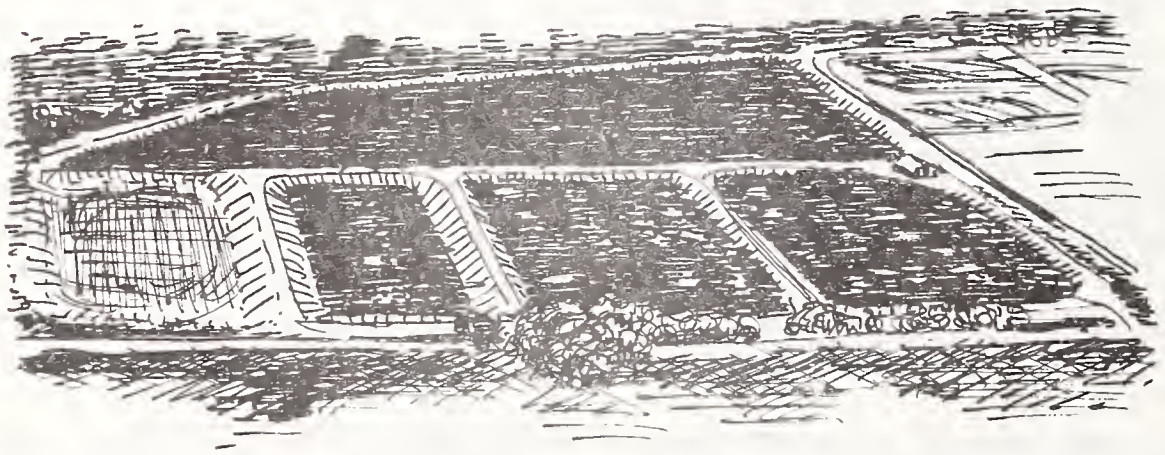
A facility with a low first cost may seem appealing because of the low initial capital outlay, but over its 20 year useful life could result in expenditures significantly greater than any first cost savings. However, even though a present worth analysis is relatively elementary, one major question remained: How can the selection of the facility's equipment be made and yet maintain the free-competitive bidding process which is the basis for most municipal improvements.

After a great deal of discussion with city officials, the Montana Water Quality Bureau (WQB), the Environmental Protection Agency, numerous suppliers, manufacturers and contractors, the project engineer determined that a performance specification and a pre-bid submittal would provide the necessary information to bid the proposed improvement in a competitive manner and achieve the desired cost savings and effluent goals.

The performance specifications required that the aeration systems be capable of dissolving 1928 pounds of oxygen per day under expected field conditions using no more than 750 ACFM of air and maintain a minimum of two milligrams per liter dissolved oxygen throughout the pond contents during series, parallel or combination loading modes.

With these basic parameters various equipment suppliers and manufacturers requested pre-bid submittal forms from Morrison-Maierle which provided the necessary field conditions and electrical power costs for determination of annual power costs. Suppliers were also required to provide any costs associated with chemicals required for proper operation of the aeration system. To verify their claims, suppliers and manufacturers were also required to enclose with the pre-bid submittal a certified report by an independent laboratory attesting to the field transfer efficiency of the individual equipment.

The project engineer, after receiving and checking the numerous pre-bid submittals, compiled a list of acceptable equipment based on performance and distributed the list to all plan holders. Interested contractors then prepared their bids for the entire project listing total installed price for each approvable aeration system. The contractors were fully aware that an economic analysis would be computed for each of the systems bid and final selection was to be made based on the results of the analysis. The end product was a facility that is capable of providing the necessary wastewater treatment and achieve this treatment in an efficient cost effective manner.



The Polson Wastewater Facility has now been in operation for almost one year and its performance is even better than predicted. Total Suspended Solids and Biochemical Oxygen Demand removal efficiencies have consistently exceeded 90 percent removal. Additionally, the Polson aerated lagoon facility has consistently achieved low concentrations of effluent fecal coliforms without disinfection with counts much less than 5,000 per 100 milliliters during the winter and as low as 100 per ml in warm weather.

Based on the effectiveness of the treatment from Polson and other similar facilities, the Montana Water Quality Bureau is reassessing disinfection requirements under certain conditions. According to Mark Weston, WQB engineer overseeing the Polson project, "The short experience of the Polson facility has shown that properly designed aerated lagoons can achieve low fecal coliform levels without disinfection. As a result, future facilities having a marginal need for disinfection may not require it because of the experience gained from the Polson facility."

Continued monitoring of the Polson plant and other similar facilities and the application of present worth analysis could result in all wastewater facilities, not only aerated lagoon systems, operating in a more efficient and economical manner. ■

Conserving Energy

Save by Shutting Off Motors

By John Molnar

Do you know how much you spend unnecessarily or how much energy you waste if you permit electric motor-driven equipment to operate during unoccupied time at your facility? With this nomograph you can quickly and easily determine the dollars saved annually when electric motors are shut off during unoccupied times.

This nomograph was constructed for occupied time of 10 hr/day, 5 days/week and observing major holidays. Time other than the defined occupied time is unoccupied time. The motors used for the nomograph are the standard three-phase, totally enclosed fan-cooled, 60 Hz, 1750 rpm operating on 460 V.

Example:

Determine the annual saving in dollars when a 5-hp circulating pump on a hot water circulating system is shut off during the unoccupied time and the average power cost is 4 cents/kwh.

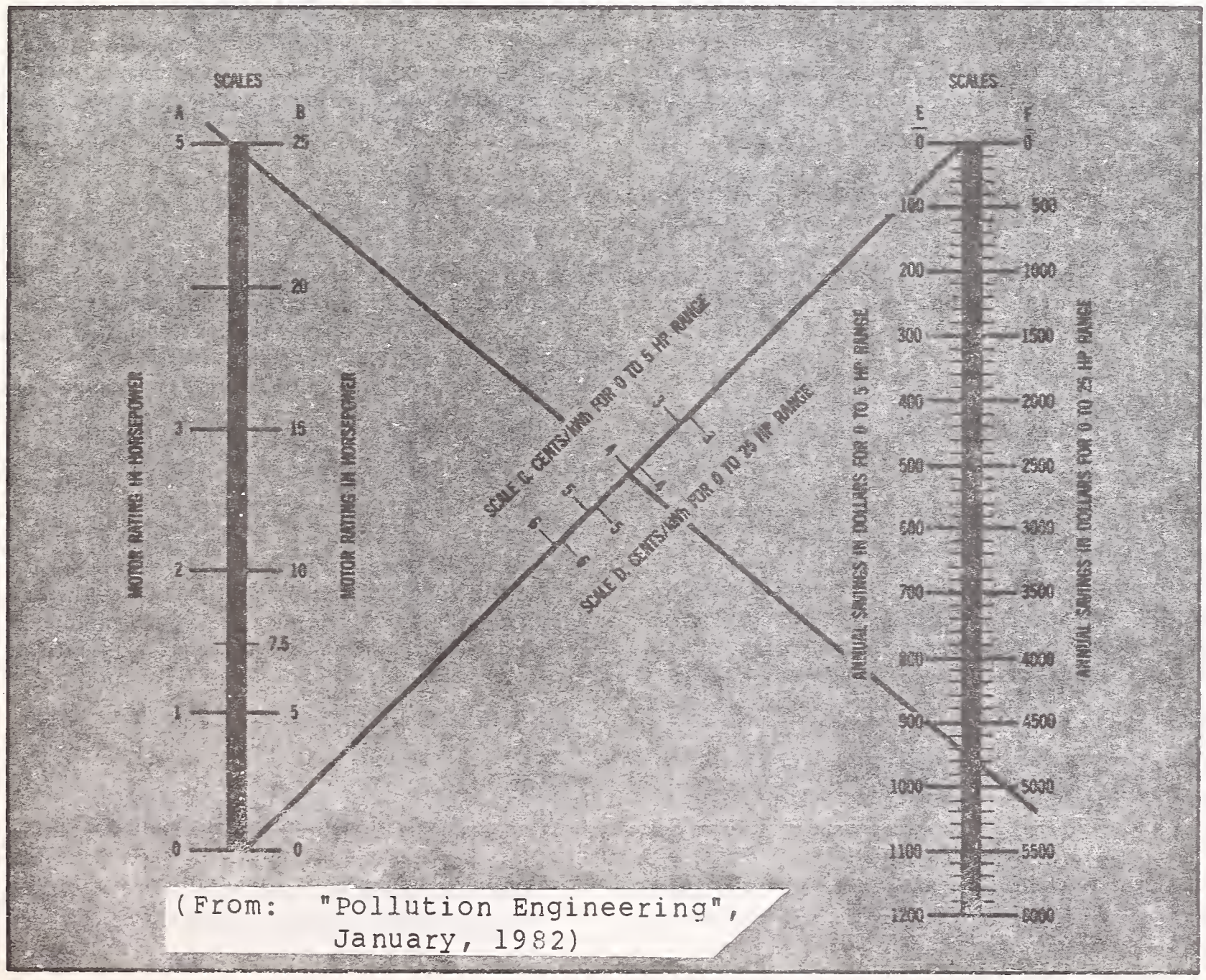
Solution:

Align 5-hp on Scale A with 4 cents on Scale C and read $950 annual saving on Scale E.

Note:

Scales A, C, and E are companion scales for 0- to 5-hp motors, and Scales B, D, and F are companion scales for 0- to 25-hp motors.

John Molnar is president of Molnar Engineering Inc., Moorestown, NJ, and a registered professional engineer.



(From: "Pollution Engineering", January, 1982)

Chlorinator Basics

By Bill Carpenter

Reprinted from National Rural Water

Many of us started repairing chlorinators with a hammer, pipe wrench, and two days of sick leave.

"Take that thing off. No, maybe this thing is the problem. Tap a little on that thing there."

This type of hit, hope, and pray repair can be costly and dangerous.

The first step in working on gas chlorinators is to understand, at least generally, how a chlorinator chlorinates. Most often the repairs you will have to make are simple and safe if you proceed cautiously and if you take time to understand the basic operating principles.

Better than trying to memorize a series of cures, let's first try to learn how the chlorinator works. In later articles we'll find out what the function of each part is and how it relates to the other parts. Then we'll be ready to search out the parts that are not functioning properly.

Like most everything else, chlorinators are simple when you know the basics, and perplexing when you don't.

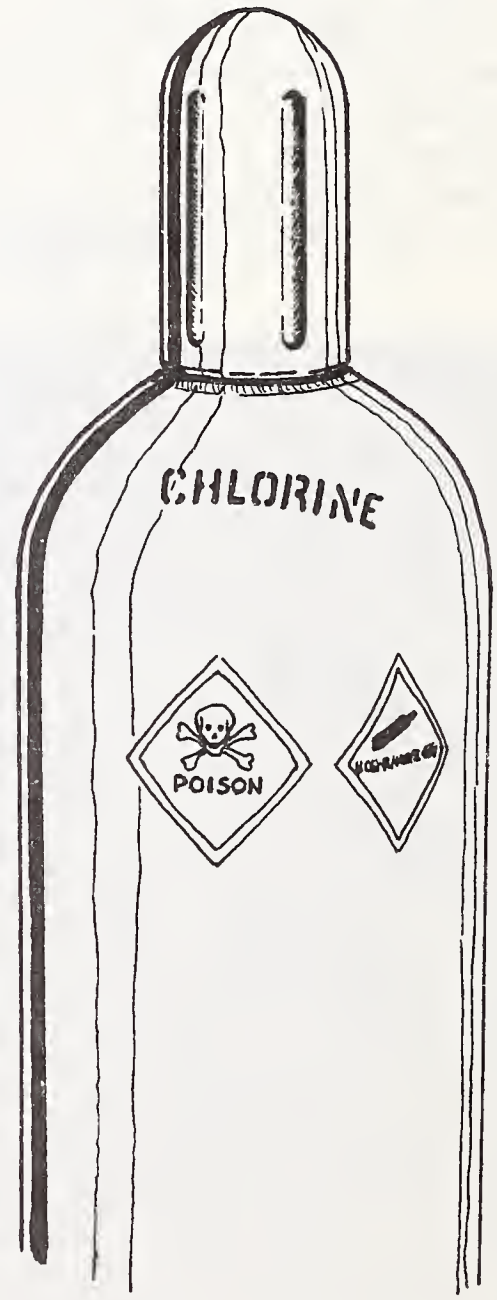
If we were trying to learn how to repair automobiles, the basic elements we would look at would be the power source under the hood (motor), how the power from the motor is transmitted (transmission), and where the power ends up (wheels)

You can see we left out some important parts. But for the sake of clarity, we will oversimplify and even stretch a few concepts. There have been times while working on our chlorinator that we tinkered with the motor when all we had was a flat tire. Let's solve that problem first.

As with the automobile, let's reduce chlorinator operations to the basics. When you hook the cylinder to the chlorinator and open the valve, here's what happens.

1. PRESSURE

Cylinder pressure sends chlorine gas up to a shut-off valve.



2. VACUUM

In order for chlorine to move past the valve, there must be a

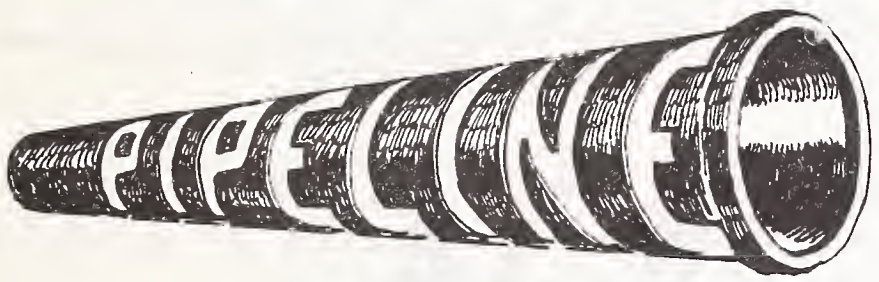
vacuum to open the valve and pull the gas through. The water going through the ejector creates this suction.

3. METER

The chlorine gas is now carried by vacuum through the metering tube where you adjust the feed rate up or down.

4. MIX

The chlorine then passes through the ejector where it is mixed with water.■



JEC Plans Safety Seminars

The Joint Education Committee (JEC) of the MSAWWA and the MWPCA plans to offer two workshops per year in different localities throughout the state according to Deanna Anderson, newly appointed chairman of the group. The JEC seminars will be held in the spring and fall. The cost is $7.50 for members of AWWA or WPCF and $10.00 for non-members. The workshop planned for this fall is Safety Awareness. It will be held during the first two weeks in November in Great Falls, Butte, Kalispell, Havre, Billings, and the Wolf Point area.

Most of us are aware of the poor safety record the water and wastewater industry has developed. Did you know that over half of the injuries that occur are either strains or sprains from lifting or twisting, or injuries from being struck by a stationary, moving, flying or falling object?

We can all benefit by learning more about safety. So plan now to attend the Safety Awareness Seminars.

For more information about the seminars or about JEC contact:

Deanna Anderson;
JEC Chairman
Montana Tech
Water Microbiological Laboratory
Butte, Mt. 59701
Telephone 496-4108

METCO Starts Operation

METCO, the Montana Environmental training Coordinating Organization, has started operating now that they have their first few members. The group had their first annual meeting on March 24, 1982 just before the AWWA-WPCF convention. Following the meeting, several members joined. METCO members are now busy coordinating a calendar of training events, developing an inventory of available training materials and searching for funding sources for future activities.

METCO president, Tim Hunter, and METCO treasurer, Jan Cranor, attended the NETA regional meeting in Orem, Utah in June. NETA, the National Environmental Trainers Association, serves as a coordinating force for trainers on the National level. At this meeting, training groups from the various states were able to compare notes. It seems that Montana is way behind some states in organizing their training efforts. For more information on how you can help us to catch up, contact:

METCO
P.O. Box 1181
Helena, MT 59624

(406) 449-2406

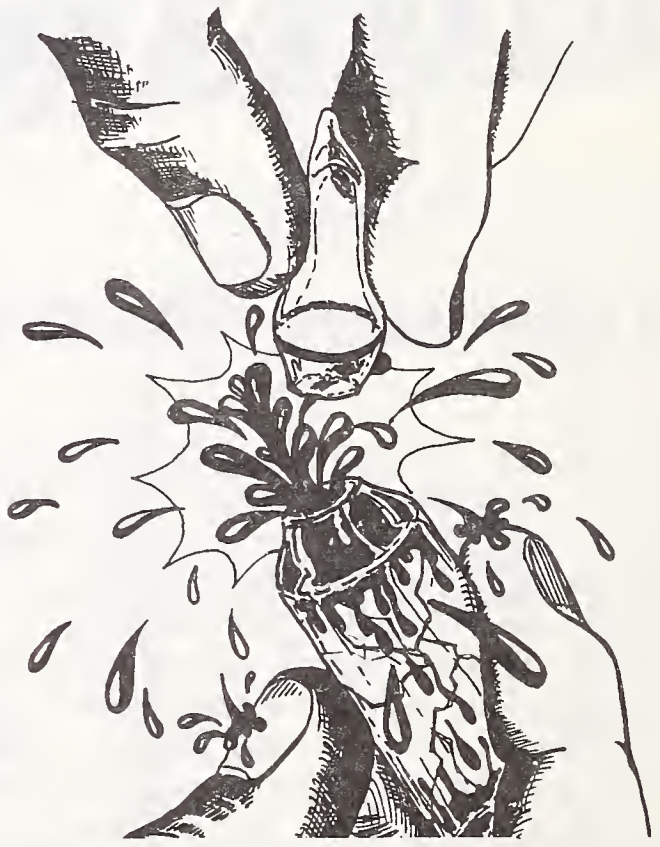
Water Samplers Have Close Call

By Jim Melstad
WQB Environmental Engineer

RECENTLY, FELLOW WQB employee Rob Green and I were sprayed in the face with concentrated nitric acid. We found out just how fast acid can eat holes in skin and clothing. We want to share our experience with everyone so that similar mishaps can be avoided in the future.

Nitric acid is used to preserve some water samples. After the sample is taken, the top of a small glass ampule filled with the acid is broken off and the contents are poured into the sample. Although Rob and I noticed nothing unusual about this particular ampule, its bottom shattered in my fingers and the acid inside sprayed Rob and I from head to toe. It was as if the stuff was under pressure. Five milliliters of acid can go a long way, and we were very lucky not to have sustained any serious injury. I got the worst of the acid and ended up with several holes in the skin on my face. Rob washed my face and eyes with water. immediately and drove me to the hospital or my injuries would have been much more serious.

Please, use extreme care when handling caustic or corrosive materials. Use eye protection if there is any chance of damage to the eyes. When opening the ampules, I suggest that you wrap the ampule in a towel and break it within the towel. If you should get acid on your skin, flush the skin with plenty of clean water for 5 minutes or more. This flushing should be done especially thoroughly if acid gets in the eyes or mouth. And, finally, get yourself to a doctor or the hospital and have a qualified person check your injuries. Don't take unnecessary chances!



Editor's Note

The Fall 1981 issue of the Big Sky Clearwater contained the article "There's Something Sickening About the Water" by Dayton Alsaker. An adaptation of the article appeared in the AWWA publication, Opflow, but the list of references which Mr. Alsaker used in development of the article were not included. We include the list of references here to insure that these authors receive proper credit.

References

1. Logsdon, Gary S., and DeWalle, Foppe B. "Filtration as a Barrier to Passage of Cysts in Drinking Water.": USEPA, Drinking Water Research Division, 26 West St. Clair Street, Cin., OH (1981).

2. Logsdon, Gary S. et al. "Alternative Filtration Methods for Removal of Giardia Cysts and Cyst Models." Jour. AWWA 73:2:111-118 (Feb., 1981)

3. Jarroll, Edward L., Alan K. Bingham, Ernest A. Meyer. "Effect of Chlorine on Giardia lamblia Cysts." Jour. of Applied Environ. Micro. 41:2:483-486 (Feb., 1981).

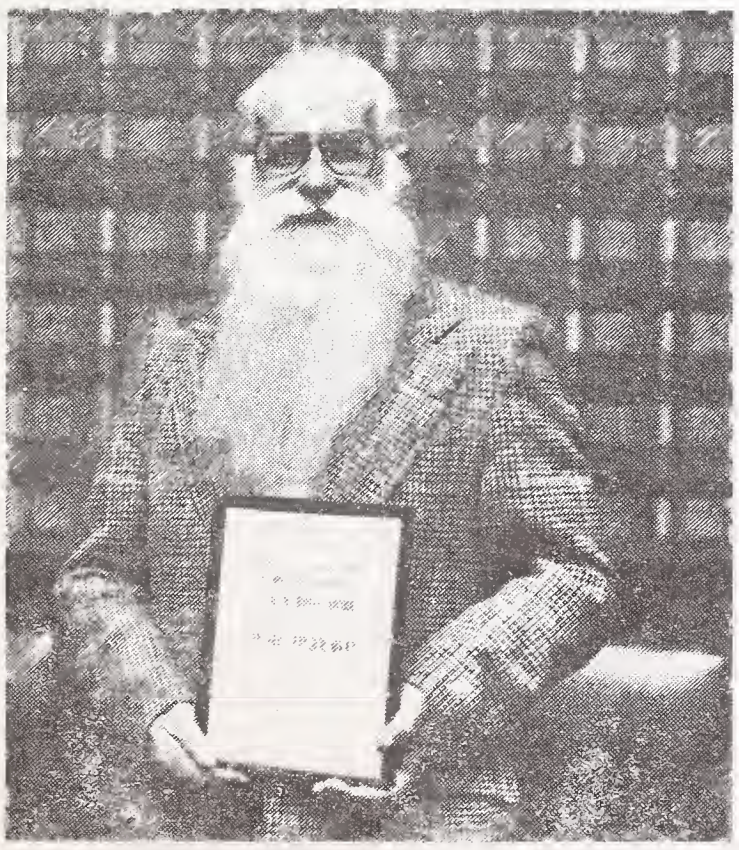
4. Logsdon, Gary S., and Lippy, Edwin C. "The Role of Filtration in Preventing Waterborne Disease." Presented at NW Regional Water Supply Short Course, U of Wash., Seattle, WA (Sept. 23-24, 1981)

5. Logsdon, Gary S., and Fox, Kim R. "Getting Your Money's Worth from Filtration." Presented at NW Section Annual Meeting, Spokane, WA (May 8, 1981).

6. Engeset, J., and F.B. DeWalle. "Removal of Giardia lamblia Cysts by Flocculation and Filtration." Proc. AWWA Annual Conf. San Francisco. Calif. (1979).

Santa Found?

It's a little early to be thinking about Christmas, but when we saw this picture in the Saskatchewan Operators Clear Water Reporter visions of sugar plums began dancing in our heads. Who is this jolly looking, white haired old fellow from the far north? His name is "Wib" Walby and he is shown here holding the H.M. Bailey Award at the 1981 Western Canada Water and Sewage conference convention held in Saskatoon, Saskatchewan, Canada. The award is given to someone involved in the full time operation of a water or sewage treatment plant. The individual must have 15 years of service (Wib has 26) and must have provided long, faithful and meritorious service in the water or sewage treatment field. What better way for old St. Nick to spend the off season?



Stop Leak

The City of Helena has found a unique way to recycle their old stop signs. They are bolting them to the back sides of perforated manhole covers to keep stormwater out of the sewer system. Some of Helena's storm sewers are connected to the sanitary sewers.

Operators' Certification Corner

Sample Certification Test Questions

1. Four items needed to perform a total solids test in the lab are:

   a. vacuum pump, drying oven, balance, filter flask
   b. drying oven, desiccator, evaporating dish, balance
   c. spectrophotometer, desiccator, pH meter, balance
   d. filter flask, evaporating disk, vacuum pump, balance

2. When a chlorinated wastewater sample is collected for BOD, it must be dechlorinated and then it must be

   a. brought up to room temperature
   b. filtered
   c. reseeded
   d. aerated
   e. checked for dissolved sulfides

3. Total Kjeldahl nitrogen is the sum of

   a. organic nitrogen and ammonia
   b. ammonia nitrogen and ammonium chloride
   c. ammonia - nitrogen and organic nitrogen
   d. ammonium and nitrites

4. The difference between the static level and the pumping level of a well is called the

   a. cone of depression
   b. radius of influence
   c. zone of saturation
   d. drawdown

5. Which of the following is <u>NOT</u> a possible contributing cause to air binding in a filter?

   a. operation under a negative head condition
   b. an increase in the temperature of the water during filtration
   c. a broken diffuser for the air scour unit
   d. release of oxygen from algae in the filter

6. Which of the following would not be used for coagulation?

   a. alum
   b. ferric sulfate
   c. bentonite
   d. chlorine dioxide

Answers
1. b
2. c
3. c
4. d
5. c
6. d

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